Work Productivity and Activity Impairment Allergic Specific (WPAI-AS) Questionnaire using Mobile Technology

Work Productivity and Activity Impairment Allergic Specific (WPAI-AS) Questionnaire using Mobile Technology: The MASK study

J Bousquet, MD [1,2], O VandenPlas, MD [3], M Bewick, MD [4], S Arnavielhe, PhD [5], A Bedbrook, BSc [1], R Murray, PhD [6], M van Eerd, MSc [7], J Fonseca, MD [8], M Morais-Almeida, MD [9], A Todo Bom, MD [10], AA Cruz, MD [11], F Sarquis Serpa, MD, [12] J da Silva, MD, [13] E Menditto, PhD, [14], G Passalacqua, MD [15], C Stellato , MD, [16] , MT Ventura, MD [17], D Caimmi, MD [18], P Demoly, MD [18], KC Bergmann, MD [19], T Keil, MD [20], L Klimek, MD [21], R Mösges, MD [22], S Shamai, MD, [22] T Zuberbier, MD [19], D Larenas-Linnemann, MD [23], M Rodriguez Gonzalez, MD, [24] MT Burguete Cabañas, MD, [25] D Ryan, MD [26], A Sheikh, MD [27], JM Anto, MD [28], J Mullol, MD [29], A Valero, MD [29] ML Kowalski, MD [30], P Kuna, MD [31], B Samolinski, MD [32], PV Tomazic, MD [33], S Bosnic-Anticevich, PhD [34], RE O'Hehir MD, [35], G De Vries, MSc [7], D Laune, PhD [5]

1. MACVIA-France, Contre les MAladies Chroniques pour un VIeillissement Actif en France European Innovation Partnership on Active and Healthy Ageing Reference Site, Montpellier, France.
2. INSERM U 1168, VIMA : Ageing and chronic diseases Epidemiological and public health approaches, Villejuif, Université Versailles St-Quentin-en-Yvelines, UMR-S 1168, Montigny le Bretonneux, France and Euforea, Brussels, Belgium
3. Department of Chest Medicine, Centre Hospitalier Universitaire UCL Namur, Université Catholique de Louvain, Yvoir, Belgium.
4. iQ4U Consultants Ltd, London, UK.
5. Kyomed , Montpellier France.
6. Medical Communications Consultant, MedScript Ltd, Dundalk, Co Louth, Ireland.
7. Peercode DV, Gerdermalsen,The Netherlands.
8. Center for Health Technology and Services Research- CINTESIS, Faculdade de Medicina, Universidade do Porto; and Allergy Unit, CUF Porto Instituto & Hospital, Porto, Portugal.
9. Allergy Center, CUF-Descobertas Hospital, Lisboa, Portugal.
10. Imunoalergologia, Centro Hospitalar Universitário de Coimbra and Faculty of Medicine, University of Coimbra, Portugal.
11. ProAR – Nucleo de Excelencia em Asma, Federal University of Bahia, Brasil and GARD Executive Committee, Brazil.
12. Asthma Reference Center, Escola Superior de Ciencias da Santa Casa de Misericordia de Vitoria, ES, Brazil.
13. Allergy Service, University Hospital of Federal University of Santa Catarina (HU-UFSC), Florianopolis, SC, Brazil.
14. CIRFF, Center of Pharmacoeconomics, University of Naples Federico II , Naples, Italy.
15. Allergy and Respiratory Diseases, Policlinico San Martino, University of Genoa, Italy
16. Department of Medicine, Surgery and Dentistry "Scuola Medica Salernitana", University of Salerno, Salerno, Italy.
17. University of Bari Medical School, Unit of Geriatric Immunoallergology, Bari, Italy.
18. CHRU de Montpellier, Sorbonne Universités, UPMC Paris 06, UMR-S 1136, IPLESP, Equipe EPAR, F-75013 Paris, France.
19. Comprehensive Allergy-Centre-Charité, Department of Dermatology and Allergy, Charité - Universitätsmedizin Berlin; Global Allergy and Asthma European Network (GA^{2}LEN), Berlin, Germany.
20. Institute of Social Medicine, Epidemiology and Health Economics, Charité - Universitätsmedizin Berlin, Berlin, and Institute for Clinical Epidemiology and Biometry, University of Wuerzburg, Germany
21. Center for Rhinology and Allergology, Wiesbaden, Germany.
22. Institute of Medical Statistics, and Computational Biology, Medical Faculty, University of Cologne, Germany and CRI-Clinical Research International-Ltd Hamburg, Germany.
23. Center of Excellence in Asthma and Allergy, Hospital Médica Sur, México City, Mexico.
24. Pediatric Allergy and Clinical Immunology, Hospital Angeles Pedregal, Mexico City, Mexico.
25. Centro Médico Zambrano Hellion, Monterrey, Mexico.
26. Allergy and Respiratory Research Group, Usher Institute of Population Health Sciences and Informatics, University of Edinburgh, UK
27. Director, Asthma UK Centre for Applied Research, Centre of Medical Informatics, Usher Institute of Population Health Sciences and Informatics, The University of Edinburgh, Edinburgh, UK.
28. ISGoBAL, Centre for Research in Environmental Epidemiology (CREAL), Barcelona, Spain; IMIM (Hospital del Mar Research Institute), Barcelona, Spain; CIBER Epidemiología y Salud Pública (CIBERESP), Barcelona, Spain; Universitat Pompeu Fabra (UPF), Barcelona, Spain.
29. Pneumology and Allergy Department Hospital Clínic, Clinical & Experimental Respiratory Immunoallergy, IDIBAPS, CIBERES, University of Barcelona, Spain.
30. Department of Immunology, Rheumatology and Allergy, Medical University of Lodz, and HARC, Poland.
31. Division of Internal Medicine, Asthma and Allergy, Barlicki University Hospital, Medical University of Lodz, Poland.
32. Department of Prevention of Envinronmental Hazards and Allergology, Medical University of Warsaw, Poland.
33. Department of ENT, Medical University of Graz, Austria
34. Woolcock Institute of Medical Research, University of Sydney and Sydney Local Health District, Glebe, NSW, Australia.
35. Department of Allergy, Immunology and Respiratory Medicine, Alfred Hospital and Central Clinical School, Monash University, Melbourne, Victoria, Australia; Department of Immunology, Monash University, Melbourne, Victoria, Australia.

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Corresponding author:

Professor Jean Bousquet
CHU Montpellier, 371 Avenue du Doyen Gaston Giraud, 34295 Montpellier Cedex 5, France
Tel +33 611 42 88 47 jean.bousquet@orange.fr

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Uncontrolled allergic and non-allergic rhinitis have a major impact on work productivity and absenteeism [1]. The Work Productivity and Activity Impairment Allergic Specific Questionnaire (WPAI-AS) has been used in many studies [2-7]. Work productivity impairment assessed using the WPAI-AS has been associated with allergic rhinitis (AR) severity [7]. We have found using mobile technology based visual analogue scales (VAS) that work productivity is impaired in moderate/severe AR [8].

MASK-rhinitis (MACVIA-ARIA Sentinel NetworK for allergic rhinitis) is an ICT system centred around the patient [9] using a mobile phone app (*Allergy Diary)*. App users are asked to complete a short demographic questionnaire and WPAI-AS thus providing baseline characteristics of their disease. *The Allergy Diary* has been launched in 21 countries.

In order to better assess the loss of work productivity in AR, we tested the WPAI-AS using the Allergy Diary.

A cross-sectional study was carried out from June 1, 2016 to July 31, 2017 in all consecutive users of the Allergy Diary (12,636) who filled in the WPAI-AS. The description of the Allergy Diary is reported in previous papers [8,10]. The app collects information on AR symptoms experienced (nasal and ocular), disease type (intermittent/persistent), how symptoms impact users' lives, and type(s) of AR treatment used. The system has been deployed in 21 countries and in 16 languages (translated and back-translated, culturally adapted and legally compliant). The data are anonymized, except for geolocalized data that are never totally anonymous. An Independent Review Board approval was not needed.

The electronic form of the WPAI-AS Questionnaire was applied in the seven available languages (i.e. English, French, German, Italian, Polish, Portuguese and Spanish) (8, 10) according to the package obtained from Reilly and associates (www.reillyassociates.net/WPAI_General.html). The percentages of impairment due to allergy for daily activities (Q9: degree allergy affected regular activities) or work productivity (Q4: degree allergy affected productivity while working) were the outcomes used.

Since the results were not normally distributed for Q4 and Q9 (Shapiro-Wilk test), medians and interquartile ranges, percentiles and non-parametric tests were used.

Of the 12,636 registered users, 1,017 filled in the WPAI-AS Q9 and 698 the Q4 (Table 1 online). There were 629 women (61%) and 405 men (39%), with a mean age of 26 ± 16 years. The repartition of countries was:

- Austria 7 users
- Australia 6
- Brazil 198
- Canada 3
- France 126
- Germany 96
- Italy 126
- Mexico 85
- Poland 43
- Portugal 294
- Spain 66
- Switzerland 89
- UK 73

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Similar levels of WPAI-AS percentages of impairment were found for Q4 (N= 698, median and 25-75 percentiles: 20, 4-50) and for Q9 (N= 1,017; 17, 3-45).

There was a highly significant correlation between the two questions (Figure 1). For a Q4 percentage of impairment of over 50, all but one user reported no impairment of work productivity. In users with Q4 ≥50, 18% had a Q9<50.

Analysis of data from this pilot of establishing an ICT-based care system for AR found that the level of work impairment is highly correlated with the degree that allergy affected regular activities using the two validated questions of the WPAI-AS on global and work impairment.

The strengths and limitations of this study are those of mobile technology lengthily discussed previously [8,10]. A key limitation was that there was a lack of patient characterization, which is impossible using an app. However, every observational study we have performed using the *Allergy Diary* has confirmed the potential to identify users with severe disease. It is likely that mobile technology will become a very important tool of the understanding and management of AR.

The WPAI-AS scores observed in the study are lower than those reported in patients selected by physicians [2-7]. This is because many users have mild rhinitis whereas in clinical trials or in patients selected by physicians AR is usually more severe.

The results of the study are in line with two previous studies using the same App. These three studies used different, but complementary tools. In the first study, a global question was assessed at baseline ("How my symptoms affect my school or work?") [10] and it was found that impairment was associated with troublesome symptoms, ocular symptoms and nasal obstruction. In the second study, VAS work was correlated with global allergy symptoms (N=5,678 days, Rho=0.82), rhinitis (Rho=0.80), eye symptoms (Rho=0.70) and asthma (Rho=0.56). In this third study, there is a highly significant correlation between the Q4 (degree allergy affected productivity while working) and Q9 (degree allergy affected regular activities) WPAI-AS questions. Together, the findings from these studies indicate that three different tools used in a large number of countries and languages with cultural differences give very similar results. There is a very strong correlation between the severity of rhinitis and work productivity. However, as found in the three studies, some work impairment is also found in users with milder rhinitis symptoms.

Work productivity is a major problem in rhinitis sufferers. Those with severe symptoms have almost always some work impairment, but work impairment is not restricted to moderate and severe patients.

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REFERENCES

1. Ojeda P, Sanz de Burgoa V, Coste Asma S. Costs associated with workdays lost and utilization of health care resources because of asthma in daily clinical practice in Spain. J Investig Allergol Clin Immunol. 2013;23(4):234-41.
2. Bousquet J, Neukirch F, Bousquet PJ, Gehano P, Klossek JM, Le Gal M, et al. Severity and impairment of allergic rhinitis in patients consulting in primary care. J Allergy Clin Immunol. 2006;117(1):158-62.
3. Stull DE, Roberts L, Frank L, Heithoff K. Relationship of nasal congestion with sleep, mood, and productivity. Curr Med Res Opin. 2007;23(4):811-9.
4. Bousquet J, Bodez T, Gehano P, Klossek JM, Liard F, Neukirch F, et al. Implementation of Guidelines for Allergic Rhinitis in Specialist Practices. A Randomized Pragmatic Controlled Trial. Int Arch Allergy Immunol. 2009;150(1):75-82.
5. Mansfield LE, Hampel F, Haeusler JM, Georges G. Study of levocetirizine in seasonal allergic rhinitis. Curr Med Res Opin. 2010;26(6):1269-75.
6. Meltzer EO, Munafo DA, Chung W, Gopalan G, Varghese ST. Intranasal mometasone furoate therapy for allergic rhinitis symptoms and rhinitis-disturbed sleep. Ann Allergy Asthma Immunol. 2010;105(1):65-74.
7. Colas C, Brosa M, Anton E, Montoro J, Navarro A, Dordal MT, et al. Estimate of the total costs of allergic rhinitis in specialized care based on real-world data: the FERIN Study. Allergy. 2017;72(6):959-66.
8. Bousquet J, Bewick M, Arnavielhe S, Mathieu-Dupas E, Murray R, Bedbrook A, et al. Work productivity in rhinitis using cell phones: The MASK pilot study. Allergy. 2017.
9. Bousquet J, Hellings PW, Agache I, Bedbrook A, Bachert C, Bergmann KC, et al. ARIA 2016: Care pathways implementing emerging technologies for predictive medicine in rhinitis and asthma across the life cycle. Clin Transl Allergy. 2016;6:47.
10. Bousquet J, Caimmi DP, Bedbrook A, Bewick M, Hellings PW, Devillier P, et al. Pilot study of mobile phone technology in allergic rhinitis in European countries: the MASK-rhinitis study. Allergy. 2017;72(6):857-65.

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